RFG.006CP1 PATENT

ENDOSCOPIC SMART PROBE AND METHOD

This application is a continuation-in-part of U.S. patent application serial number 09/259,194 entitled "Endoscopic Smart Probe and Method" filed March 1, 1999, incorporated by reference herein in its entirety.

Background of the Invention

1. Field of the Invention

The present invention relates to the field of medical instrumentation, specifically to the use of smart technology within miniature remote devices for the inspection, diagnosis, and treatment of internal organs of living organisms.

2. Description of Related Technology

Endoscopic and colonoscopic techniques are commonly used to inspect the accessible upper and lower portions, respectively, of the human gastrointestinal tract. A traditional endoscopic inspection of a human being (an example of which is the "EGD") requires the patient to be partially or completely sedated while a long, thin, tubular probe is introduced into the esophagus, routed through the stomach, and ultimately into the upper portion of the small intestine (duodenum). This tubular probe typically contains a self-illuminating fiber optic cable and viewing device to allow visual inspection of tissue in the vicinity of the probe tip. See, for example, U.S. Patent No. 3,901,220, "Endoscopes" issued August 26, 1975. However, due to the tortuous path, fragility, small diameter, and length of the digestive tract, prior art endoscopic inspection such as the aforementioned EGD is limited to only the stomach and upper portions of the small intestine. See Fig. 1.

Similarly, traditional colonoscopic examination utilizes a thin, tubular fiber optic probe inserted into the large intestine (colon) via the rectum. Even the most penetrating colonoscopic inspections are limited to the colon and the terminal portion of the small

U.S. Patent No. 5,350,569 entitled "Storage of Nuclear Materials by Encapsulation in Fullerenes" issued September 27, 1994, and U.S. Patent No. 5,640,705 entitled "Method of Containing Radiation Using Fullerene Molecules" 5,640,705 issued June 17, 1997; U.S. Patent No. 6,171,451 entitled "Method and apparatus for producing complex carbon molecules" issued January 9, 2001; U.S. Pat. Nos. 5,510,098, 5,316,636, 5,494,558 and 5,395,496, which use various processes to vaporize carbon rods, producing carbon atoms that recombine into fullerenes; U.S. Patent No. 5,951,832, "Ultrafine particle enclosing fullerene and production method thereof" issued September 14, 1999, wherein atomic or crystalline species are driven into nanostructure structures using an energetic electron beam; and U.S. Patent No. 5,965,267 entitled "Method for producing encapsulated nanoparticles and carbon nanotubes using catalytic disproportionation of carbon monoxide and the nanoencapsulates and nanotubes formed thereby" issued October 12, 1999, which are incorporated by reference herein in their entirety.

Furthermore, the shape of all C-60 structures is not necessarily spherical. Football and cigar shaped structures have been reported, and very long capped tubes ("bucky tubes", or carbon nanotubes) have been produced. Nanotubes generally comprise a network of hexagonal graphite rolled up onto itself to form a hollow tube-like structure. These nanotubes have been made with diameters as small as roughly one (1) nanometer. The length-to-width aspect ratio of nanotubes can be made extremely high, with lengths on the order of a millimeter or more (1E06 nm) compared to diameters on the order of a few nm. Single-walled carbon nanotubes (SWNTs) are produced by any one of several methods, including (i) carbon arcing to vaporize a metal-impregnated carbon electrode; (ii) laser ablation of a heated target; and (iii) catalytic chemical vapor deposition (CCVD), the latter comprising a low temperature technique more suited for large scale production of nanotubes. See, for example, U.S. Patent No. 5,916,642 entitled "Method of encapsulating a material in a carbon nanotube" issued June 29, 1999, incorporated herein by reference in its entirety.